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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

UTILITY APPLICATION AND APPLICATION FEE TRANSMITTAL (1.53(b))

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Sir:

Transmitted herewith for filing is the patent application of

Named Inventor(s) and
Address(es):   Teruo HIEDA, 2108-1-409, Kitahassakucho, Midori-ku, Yokohama-shi, Kanagawa-ken, Japan

For: IMAGE PROCESSING APPARATUS, METHOD AND COMPUTER-READABLE STORAGE MEDIUM

Enclosed are:

[X] 17   page(s) of specification, 1 page(s) of Abstract, 5 page(s) of claims

[X] 4   sheets of drawing   [X] formal   [ ] informal

[X] 6   Page(s) of Declaration and Power of Attorney

     [ ] Unsigned
     [X] Newly Executed
     [ ] Copy from prior application

          [ ] Deletion of inventors including Signed Statement under 37 C.F.R. § 1.63(d)(2)

[X]   Incorporation by Reference: The entire disclosure of the priority application(s) identified below, is considered as being part of the disclosure of the accompanying application and is incorporated herein by reference.

[ ]   Microfiche Computer Program (Appendix)

[ ]   _____ page(s) of Sequence Listing

     [ ]   computer readable disk containing Sequence Listing
     [ ]   Statement under 37 C.F.R. § 1.821(f) that computer and paper copies of the Sequence Listing are the same

[X]   Claim for Priority Japanese Application No. 11-041860 filed 2/19/99

520645_1

[ ]   Certified copy of Priority Document(s)

    [ ]   English translation documents

[X]   Information Disclosure Statement

    [X]   Copy of 8_Cited references w/ English Abstracts

    [ ]   Copy of PTO-1449 filed in parent application serial No._____

[ ]   Preliminary Amendment

[X]   Return receipt postcard (MPEP 503)

[X]   Assignment Papers (assignment cover sheet and assignment documents)

    [X]   A check in the amount of $40.00 for recording the Assignment.

    [ ]   Assignment papers filed in parent application Serial No. _____.

    [ ]   Certification of chain of title pursuant to 37 C.F.R. § 3.73(b).

[ ]   This is a [ ] continuation [ ] divisional [ ] continuation-in-part (C-I-P) of prior application serial no. _____.

    [ ]   Cancel in this application original claims _____ of the parent application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

    [ ]   A preliminary Amendment is enclosed. (Claims added by this Amendment have been properly numbered consecutively beginning with the number following the highest numbered original claim in the prior application.

[ ]   The status of the parent application is as follows:

    [ ]   A Petition For Extension of Time and a Fee therefor has been or is being filed in the parent application to extend the term for action in the parent application until _____.

    [ ]   A copy of the Petition for Extension of Time in the co-pending parent application is attached.

    [ ]   No Petition For Extension of Time and Fee therefor are necessary in the co-pending parent application.

[ ]   Please abandon the parent application at a time while the parent application is pending or at a time when the petition for extension of time in that application is granted and while this application is pending has been granted a filing date, so as to make this application co-pending.

    [ ]   Transfer the drawing(s) from the patent application to this application.

[ ]   Amend the specification by inserting before the first line the sentence:
This is a [ ] continuation [ ] divisional [ ] continuation-in-part of co-pending application Serial No._____   filed _____.

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I. CALCULATION OF APPLICATION FEE (For Other Than A Small Entity)

	Number Filed		Number Extra	Rate	Basic Fee $ 690.00
Total Claims	12	-20=	0	x$18.00	$ 0
Independent Claims	2	- 3=	0	x78.00	$ 0
Multiple Dependent Claims	[ ] yes		Additional Fee =	$260.00	$ 0
	[ ] no		Add'l Fee =	NONE	

Total: $690.00

[ ] A statement claiming small entity status is attached or has been filed in the above-identified parent application and its benefit under 37 C.F.R. § 1.28(a) is hereby claimed. Reduced fees under 37 C.F.R. § 1.9(F) (50% of total) paid herewith $ _____.

[X] A check in the amount of $690.00 for payment of the application filing fees is attached.

[ ] Charge Fee(s) to Deposit Account No. 13-4500. Order No. _____. A DUPLICATE COPY OF THIS SHEET IS ATTACHED.

[X] The Assistant Commissioner is hereby authorized to charge any additional fees which may be required for filing this application, or credit any overpayment to Deposit Account No. 13-4500, Order No. 1232-4612. A DUPLICATE COPY OF THIS SHEET IS ATTACHED.

Respectfully submitted,

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Applicant(s)	:	Teruo Hieda	
Serial No.	:	TBA	Group Art Unit: TBA
Filed	:	February 9, 2000 (Herewith)	Examiner: TBA
For	:	IMAGE PROCESSING APPARATUS, METHOD AND COMPUTER-READABLE STORAGE MEDIUM	

EXPRESS MAIL CERTIFICATE

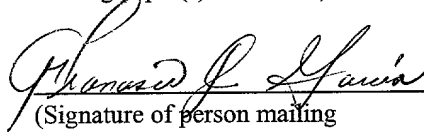Express Mail Label No. EJ604723822US

Date of Deposit ___February 9, 2000___

 I hereby certify that the following attached paper(s) and/or fee
Application Fee Transmittal (in duplicate); 17 pp. of specs., 1 page of abstract, 5 pp. claims (12 TOTAL claims); 4 Sheets of Formal Drawings (Figs. 14); check in the amount of $690.00; 6 pg. Executed Declaration/POA; Assignment Recordation Form Cover Sheet w/ 1 pg. Executed Assignment; Check in the amount of $40.00; and return receipt postcard

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37

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TITLE OF THE INVENTION

IMAGE PROCESSING APPARATUS, METHOD AND COMPUTER-READABLE
STORAGE MEDIUM

5

BACKGROUND OF THE INVENTION

This invention relates to an image processing
apparatus and method for processing an image signal
10   input from an image sensing device or the like, and to a
computer-readable storage medium used in the apparatus
and method.

Recent progress in digital signal processing
technologies has led to major developments in the video
15   field. In image sensing devices such as digital
cameras, signal processing circuitry has been digitized
to make possible devices exhibiting no signal
deterioration or aging, unlike the case with devices
composed of conventional analog circuits.

20   On the other hand, schemes in which signal
processing is implemented not by hardware based upon
digital circuits but by software using a CPU have also
been proposed. Because the content of signal processing
is decided by a program built into a ROM, such schemes
25   make possible adaptive processing in which the content
of processing is selected in accordance with the state

of the input image.

With the above-described signal processing approach
that relies upon digital circuitry, hardware
corresponding to all selection candidates must be
5   provided in order to execute adaptive processing. The
problem that arises is a great increase in the scale of
the circuitry.

With the approach that relies upon software for
processing, on the other hand, processing speed is
10   slower than with the hardware-implemented approach and
ordinary moving-picture signals (e.g., 720 × 240 pixels;
60 fields per second) cannot be processed in real time.

The above-mentioned problems encountered with both
approaches arise particularly when trying to reduce a
15   decline in image quality due to saturation of the image
sensor caused by a subject having a high degree of
luminance.

SUMMARY OF THE INVENTION

20

Accordingly, an object of the present invention is
to execute high-quality image processing by a simple
circuit arrangement.

According to the present invention, the foregoing
25   object is attained by providing an image processing
apparatus comprising: detecting means for detecting, in

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an entered image signal, a high-luminance portion that
exceeds a predetermined value; generating means for
generating a control signal, which has a prescribed
waveform at the periphery of the high-luminance portion

5   of the image signal, in dependence upon the detection
made by the detecting means; separating means for
separating a color signal from the image signal; and
suppression means for suppressing the separated color
signal by the control signal.

10   Further, according to the present invention, the
foregoing object is attained by providing an image
processing method comprising: a detecting step of
detecting, in an entered image signal, a high-luminance
portion that exceeds a predetermined value; a generating

15   step of generating a control signal, which has a
prescribed waveform at the periphery of the sensed high-
luminance portion of the image signal; a separating step
of separating a color signal from the image signal; and
a suppression step of suppressing the separated color

20   signal by the control signal.

Further, according to the present invention, the
foregoing object is attained by providing a computer-
readable storage medium storing a program for executing:
detection processing for detecting, in an entered image

25   signal, a high-luminance portion that exceeds a
predetermined value; generation processing for

generating a control signal, which has a prescribed

waveform at the periphery of the sensed high-luminance

portion of the image signal; separation processing for

separating a color signal from the image signal; and

5   suppression processing for suppressing the separated

color signal by the control signal.

Other objects and advantages besides those

discussed above shall be apparent to those skilled in

the art from the specification of a preferred embodiment

10   of the invention which follows. In the description,

reference is made to accompanying drawings, which form a

part thereof, and which illustrate an example of the

invention. Such example, however, is not exhaustive of

the various embodiments of the invention, and therefore

15   reference is made to the claims which follow the

description for determining the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

20   Fig. 1 is a block diagram illustrating an image

sensing device which includes an image processor in

accordance with an embodiment of the present invention;

Figs. 2A and 2B are diagrams showing an arrangement

that is useful in describing the principles of the

25   present invention;

Fig. 3 is a block diagram showing the principal

components in Fig. 1; and

Fig. 4 is a flowchart illustrating processing executed by a pattern controller in Fig. 1.

5   DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will now be described with reference to the drawings.

Fig. 1 is a block diagram illustrating an image

10   sensing drive which includes an image processor according to this embodiment of the present invention.

As shown in Fig. 1, the image sensing device includes a taking lens 1; a CCD 2, which is a color image sensor; a sample-and-hold unit 3 for rendering the

15   output signal of the CCD 2 continuous; an A/D converter 4; a color separator 5 for separating a luminance signal Y and color signals R, G, B from a digital image signal obtained by the A/D converter 4; a Y process unit 6 for subjecting the luminance signal Y to processing such as

20   a gamma correction, black-level clipping, white-level clipping and contour emphasis; a field memory 7 for delaying the input luminance signal by one field; and an output terminal 8 for the luminance signal Y.

The image sensing device further includes an RGB

25   process unit 9 for subjecting the color signals R, G, B to processing such as white balance control, a gamma

correction, black-level clipping and white-level clipping; a color-difference matrix unit 10 for subjecting the R, G, B signals to matrix processing, thereby to generate color difference signals, and for

5   multiplexing the color difference signals; a field memory 11 for delaying the multiplexed color difference signal by one field; a suppression unit 12 for suppressing the multiplexed color difference signal in conformity with a suppression signal Ss, described

10   later; and an output terminal 13 for a multiplexed color difference signal C.

The image sensing device further includes a saturation detector 14 for detecting saturation of the digital image signal; a first-in first-out (FIFO) memory

15   15; a control signal generator 16 for generating a control signal; a memory 17 for storing the control signal; and a suppression-signal generator 18 for reading the control signal out of the memory 17, generating the suppression signal Ss and outputting the

20   same.

The operation of this arrangement will now be described.

The image of a subject (not shown) is formed on the photoelectric converting surface of the CCD 2 by the

25   taking lens 1. This image is composed of electric charge obtained by photoelectric conversion. The

electric charge within the CCD 2 is transferred
successively by driving pulses generated by a driving-
pulse generating circuit (not shown), is converted to
voltage at the output of the CCD 2 and is output as a
5   captured-image signal. The captured-image signal is
sampled continuously by the sample-and-hold unit 3 and
is converted to a digital image signal by the A/D
converter 4.

The digital image signal is converted to the
10   luminance signal Y and color signals R, G, B by the
color separator 5. The luminance signal Y is subjected
to processing such as a gamma correction, black-level
clipping, white-level clipping and contour emphasis in
the Y process unit 6 and then is delayed by one field by
15   the field memory 7. The resulting signal is output to
equipment such as a television monitor or VTR, along
with a C signal, described later, from the Y output
terminal 8.

The color signals R, G, B in the output of the
20   color separator 5 are subjected to processing such as
white balance control, a gamma correction, black-level
clipping and white-level clipping in the RGB process
unit 9 and then are converted to color difference
signals R-Y and B-Y in the color-difference matrix unit
25   10, after which the signals are multiplexed by dot-
sequencing to provide a multiplexed color difference

signal. The multiplexed color difference signal is
delayed by one field in the field memory 11 and is
suppressed in conformity with the suppression signal Ss
in the suppression unit 12. The resulting signal is
5   output from the C output terminal 13.

The digital image signal output of the A/D
converter 4 has its saturation detected by the
saturation detector 14 through a method such as one that
detects a portion of the signal that exceeds a
10 predetermined threshold value. A signal indicative of
the detected saturation is stored temporarily in the
FIFO memory 15. The signal indicative of saturation
stored in the FIFO memory 15 is converted by the control
signal generator 16 to a control signal for suppressing
15 the color signals. The control signal is then written
to the memory 17. The control signal that has been
written to the memory 17 is read out by the suppression-
signal generator 18 and is output as the suppression
signal Ss, namely the control signal of the suppression
20 unit 12. This control signal suppresses the above-
mentioned color signals.

Fig. 2A and 2B are diagrams useful in describing
the principles of the embodiment.

Fig. 2A illustrates a decline in image quality
25 caused by a high-luminance subject. By way of the
example, the portion illustrated as the high-luminance

portion is a subject which causes sunlight to impinge
upon the taking lens 1 by reflection at a mirror
surface. Because the high-luminance portion generates
electric charge in the CCD 2 that exceeds the saturation
5   level, the color carrier signal in the output signal
vanishes and this causes an image deterioration
phenomenon referred to as high-luminance false color.
This makes it necessary to suppress the color signals.

Phenomena that occur at the portion indicated in
10   the area of image deterioration surrounding the high-
luminance portion include aberration of the taking lens
1, particularly aberration referred to as axial
chromatic aberration, in which focal length changes
owing to the wavelength of the light; optical
15   deterioration such as flare and ghosts; and so-called
blooming, in which electric charge produced on the CCD 2
overflows at the periphery. As a consequence,
unnecessary coloration occurs and results in a decline
in image quality.

20   Fig. 2B illustrates a color-signal suppression
characteristic with regard to the area of image
deterioration. As mentioned above, unnecessary
coloration is produced in the high-luminance portion and
at the periphery of the high-luminance portion and, as a
25   consequence, it is necessary to suppress the color
signals. The characteristic of this phenomenon is as

follows:

(1)   The unnecessary colors are centered on the high-luminance portion and decrease as distance from the center of the high-luminance portion increases.

5   (2)   If there is a discontinuous characteristic between the portion subjected to suppression and the periphery thereof, a dummy contour will be produced and image quality will undergo a marked decline.

For these reasons, it is necessary to adopt a

10   suppression characteristic in which color gain is made zero in the high-luminance portion and suppression is reduced as the periphery is approached and is eliminated at a location beyond a predetermined distance from the high-luminance portion.   Fig. 2B illustrates this

15   characteristic.

Fig. 3 is a block diagram illustrating the details of construction of the components 14 to 18, which are the principal components in Fig. 1.

As shown in Fig. 3, the saturation detector 14

20   includes a register 101 for storing a predetermined threshold value and a comparator 102.   The control signal generator 16 includes a pattern controller 103; a readout register 104 for storing data that has been read out of the FIFO 15; an address generator 105 for

25   generating a write address of the memory 17; adders 106 and 107; and a pattern generator 108 for generating a

predetermined pattern. The suppression-signal generator 18 includes a read-out address generator 109 for generating a read-out address of the memory 17, and a level converter 110.

5   The operation of the components described above will now be described.

A digital image signal SAD, which is the output of the A/D converter 4, is compared in the comparator 102 with a predetermined threshold value from the register

10   101. The output Sw of the comparator 102, which output corresponds to the saturated portion of the digital image signal, is stored in the FIFO memory 15 as a horizontal scanning position PH and vertical scanning position PV generated by a timing generator, which is

15   not shown.

When a scanning position corresponding to the saturated portion is stored in the FIFO memory 15, as mentioned above, a FIFO-empty signal SFE, which represents whether information has been stored in the

20   FIFO memory 15, is read out by the pattern controller 103. When the signal SFE indicates that the FIFO is empty, no operation is performed.

When the signal SFE indicates that the FIFO is not empty, the pattern controller 103 first controls the

25   readout register 104 to read out data SRD, which represents the scanning position that corresponds to the

saturated portion and that is stored in the FIFO memory 15, and to load this data in the readout register 104.

Next, the pattern controller 103 controls the address generator 105 so that the latter generates a series of horizontal and vertical addresses AHS, AVS in a predetermined order. The generated horizontal and vertical addresses AHS, AVS are added by the adders 106, 107, respectively, to the horizontal and vertical positions, respectively, stored in the readout register 104, whereby a conversion is made to addresses the center of which is the saturated portion. The conversion outputs are input to the memory 17 as horizontal and vertical addresses AH, AV, respectively.

The pattern controller 103 further controls the pattern generator 108 so that the latter generates a prescribed two-dimensional waveform that corresponds to the addresses AHS, AVS generated by the address generator 105. At this time a value DR at the horizontal and vertical addresses of the memory 17 is read out, this value is compared with the value of the waveform generated in the manner described above and, by way of example, a larger value is written to the memory 17 as write data DW at a location designated by the horizontal and vertical addresses AHS, AVS.

Thus, the operation described above is such that if there are a plurality of saturated areas, a suppression

signal that gives priority to the largest degree of suppression can be generated.

When the generation of the series of addresses and of the two-dimensional waveform is completed, the pattern controller 103 reads out the FIFO-empty signal SFE again and repeats the above-described operation until the FIFO is emptied.

The two-dimensional waveform thus written to the memory 17 is then read out. Specifically, the read-out address of the memory 17 is generated by the read-out address generator 109 in dependence upon synchronizing signals HD and VD generated by a synchronizing signal generator (not shown), and the two-dimensional waveform is read out based upon this read-out address in accordance with television scanning. The data that has been read out is converted by the level converter 110 to a level suited to the suppression signal, the resulting signal is applied to the suppression unit 12 as the suppression signal Ss, and the color signals in the saturated portion of the CCD and in the peripheral portion thereof are suppressed in the manner described above.

Fig. 4 is a flowchart illustrating processing in a case where the pattern controller 103 is implemented by a microcomputer.

After processing starts at step S201 in Fig. 4,

the FIFO-empty signal SFE that indicates whether
information has been stored in the FIFO memory 15 is
written in at step S202. This is followed by step S203,
at which it is determined whether the FIFO-empty signal

5   SFE indicates that the FIFO is empty. Control returns
to S202 if the FIFO is empty.

If the FIFO is not empty, then control proceeds to
S204, at which the data SRD representing the scanning
position stored in the FIFO memory 15 is read out to the

10 readout register 104. Next, at S205, the address
generator 105 is controlled so as to generate the series
of horizontal and vertical addresses of the
predetermined order. Then, at S206, the pattern
generator 108 is controlled so as to generate the

15 predetermined two-dimensional waveform that corresponds
to the addresses generated by the address generator 105.
This is followed by S207, at which it is determined
whether the address generator 105 has finished address
generation. Control returns to S207 if the answer is

20 "NO" and to S202 if the answer is "YES", after which the
above-described control is repeated.

A storage medium in accordance with the present
invention will now be described.

Though the embodiment illustrated in Figs. 1 and 3

25 is implemented by hardware, it can also be implemented
by a computer system having a CPU and memory. In case

of implementation by a computer system, the memory constitutes a storage medium in accordance with the present invention. A program for executing the processing according to the flowchart of Fig. 4 and the operation described in this embodiment is stored in this storage medium.

This storage medium may be a semiconductor memory such as a ROM or RAM, an optical disk, a magneto-optic disk or a magnetic storage medium, etc., and these may be constructed in the form of a CD-ROM, floppy disk, magnetic card, magnetic tape or non-volatile memory card, etc.

Accordingly, functions equivalent to those of the foregoing embodiment can be implemented, similar effects can be obtained and the object of the present invention can be attained by using the storage medium in a system or apparatus other than that according to Figs. 1 and 4, and reading out and executing program code, which has been stored on the storage medium, by this system or by a computer.

Further, functions equivalent to those of the foregoing embodiment can be implemented, similar effects can be obtained and the object of the invention can be attained in a case where an operating system or the like running on a computer performs all or a part of the processing or in a case where, after the program codes

read from the storage medium are written in a function expansion board inserted into the computer or in a memory provided in a function expansion unit connected to the computer, a CPU or the like contained in the

5   function expansion board or function expansion unit performs all or a part of the entire process in accordance with the designation of program codes.

In accordance with the present invention, as described above, it is possible to reduce a decline in

10   the image quality of a high-luminance portion of an image signal.

Further, since information regarding a saturated area is stored in memory in order to obtain the above-described effects, means for generating a control signal

15   can be realized by a circuit having a small processing capability because it is no longer always necessary to execute processing in real time. This makes it possible to obtain the best characteristic at low cost.

Further, it is possible to reduce image

20   deterioration of an area caused by light having an intensity greater than the saturation level of the image sensor on which the light impinges.

In addition, color-signal suppression can be carried out continuously and smoothly, thereby making it

25   possible to eliminate unnecessary coloration of an image signal as well as dummy contours.

The present invention is not limited to the above embodiments and various changes and modifications can be made within the spirit and scope of the present invention. Therefore, to apprise the public of the

5   scope of the present invention, the following claims are made.

WHAT IS CLAIMED IS:

1. An image processing apparatus comprising:

detecting means for detecting, in an entered image signal, a high-luminance portion that exceeds a
5 predetermined value;

generating means for generating a control signal, which has a prescribed waveform at the periphery of the high-luminance portion of the image signal, in dependence upon the detection made by said detecting
10 means;

separating means for separating a color signal from the image signal; and

suppression means for suppressing the separated color signal by the control signal.

15 2. The apparatus according to claim 1, further comprising:

first storage means for storing an output from said detecting means, wherein said generating means generates the control signal in dependence upon an output from
20 said first storage means; and

second storage means for storing this control signal, wherein said suppression means suppresses the color signal using the control signal read out of said second storage means.

25 3. The apparatus according to claim 1, wherein the image signal is a signal of an image captured by image

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sensing means, and said detecting means detects a saturated portion of said image sensing means as the high-luminance portion.

4.   The apparatus according to claim 1, wherein the

5   control signal has a waveform for obtaining a suppression characteristic in which gain of the color signal is made zero in the high-luminance portion and suppression is reduced with distance from the high-luminance portion toward the periphery thereof and is

10   eliminated at a location beyond a predetermined distance from the high-luminance portion.

5.   An image processing method comprising:

        a detecting step of detecting, in an entered image signal, a high-luminance portion that exceeds a

15   predetermined value;

        a generating step of generating a control signal, which has a prescribed waveform at the periphery of the sensed high-luminance portion of the image signal;

        a separating step of separating a color signal from

20   the image signal; and

        a suppression step of suppressing the separated color signal by the control signal.

6.   The method according to claim 5, further comprising:

        a first storage step of storing the detected high-

25   luminance portion, wherein said generating step generates the control signal in dependence upon this

stored high-luminance portion; and

a second storage step of storing this control signal, wherein said suppression step suppresses the color signal upon reading out the stored control signal.

5   7.   The method according to claim 5, wherein the image signal is a signal of an image captured by image sensing means, and said detecting step detects a saturated portion of said image sensing means as the high-luminance portion.

10   8.   The method according to claim 5, wherein the control signal has a waveform for obtaining a suppression characteristic in which gain of the color signal is made zero in the high-luminance portion and suppression is reduced with distance from the high-luminance portion

15   toward the periphery thereof and is eliminated at a location beyond a predetermined distance from the high-luminance portion.

9.   A computer-readable storage medium storing a program for executing:

20   detection processing for detecting, in an entered image signal, a high-luminance portion that exceeds a predetermined value;

generation processing for generating a control signal, which has a prescribed waveform at the periphery

25   of the sensed high-luminance portion of the image signal;

separation processing for separating a color signal
from the image signal; and

suppression processing for suppressing the
separated color signal by the control signal.

5   10.   The storage medium according to claim 9, said
storage medium further storing:

a program for executing processing for storing the
detected high-luminance portion, wherein said generating
processing generates the control signal in dependence

10   upon this stored high-luminance portion; and

a program for executing processing for storing this
control signal, wherein said suppression processing
suppresses the color signal upon reading out the stored
control signal.

15   11.   The storage medium according to claim 9, wherein
the image signal is a signal of an image captured by
image sensing means, and said detecting processing
detects a saturated portion of said image sensing means
as the high-luminance portion.

20   12.   The storage medium according to claim 9, wherein
the control signal has a waveform for obtaining a
suppression characteristic in which gain of the color
signal is made zero in the high-luminance portion and
suppression is reduced with distance from the high-

25   luminance portion toward the periphery thereof and is
eliminated at a location beyond a predetermined distance

from the high-luminance portion.

ABSTRACT OF THE DISCLOSURE

Disclosed is an image processing apparatus for
reducing image deterioration caused by a saturated area
of an image signal obtained from an image sensor.
5   Specifically, an image signal output from a CCD has a
saturated portion thereof detected by a saturation
detector and has R, G, B signals separated from it by a
color separation unit. Color difference signals are
obtained by applying prescribed processing. A signal
10   indicative of the saturated portion is stored in a FIFO
memory and is subsequently read out. A control signal
generator generates a control signal having a prescribed
waveform at the periphery of the saturated portion, and
the control signal is stored in a memory. The control
15   signal read out of the memory is applied to a
suppression signal generator, which outputs a
suppression signal. A suppression circuit suppresses
the color difference signals in conformity with the
above-mentioned waveform.

F I G. 1

1/4
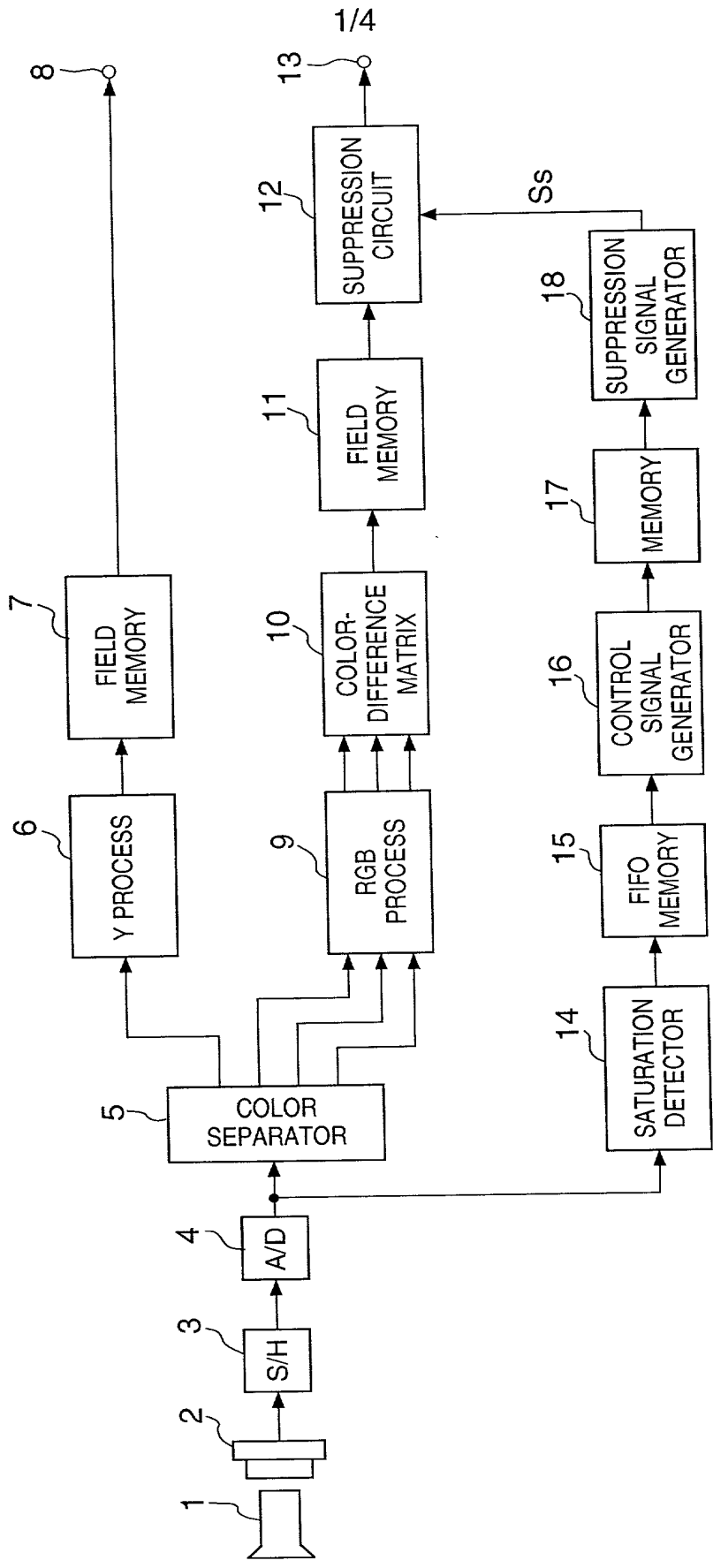
FIG. 2A

IMAGE DETERIORATION CAUSED
BY HIGH-LUMINANCE SUBJECT

HIGH-LUMINANCE PORTION

AREA OF IMAGE DETERIORATION
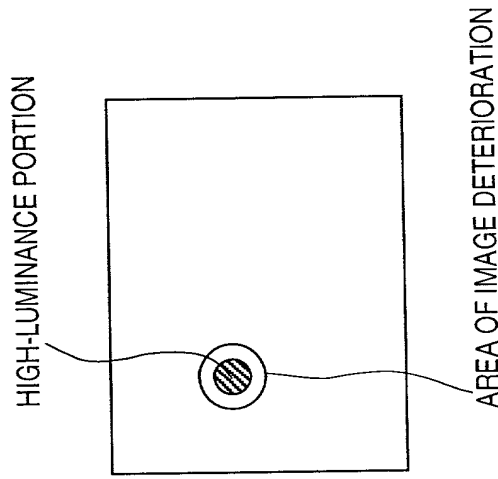
FIG. 2B

SUPPRESSION CHARACTERISTIC OF COLOR SIGNAL
IN AREA OF IMAGE DETERIORATION

COLOR
GAIN
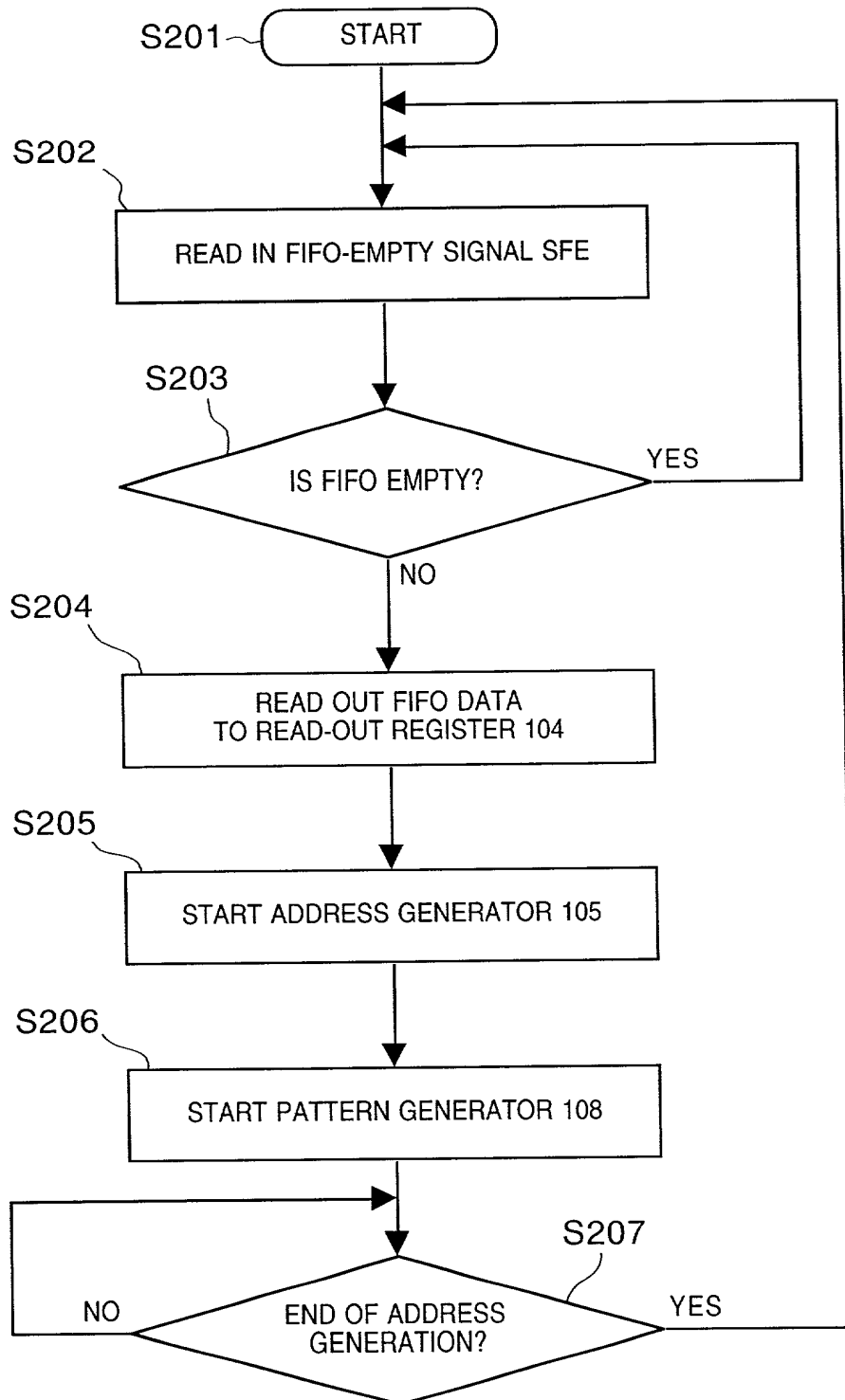
COLOR
GAIN

0

0

F I G. 3

F I G. 4

S201 — (START)

S202

READ IN FIFO-EMPTY SIGNAL SFE

S203

IS FIFO EMPTY? — YES

NO

S204

READ OUT FIFO DATA
TO READ-OUT REGISTER 104

S205

START ADDRESS GENERATOR 105

S206

START PATTERN GENERATOR 108

S207

NO — END OF ADDRESS
GENERATION? — YES
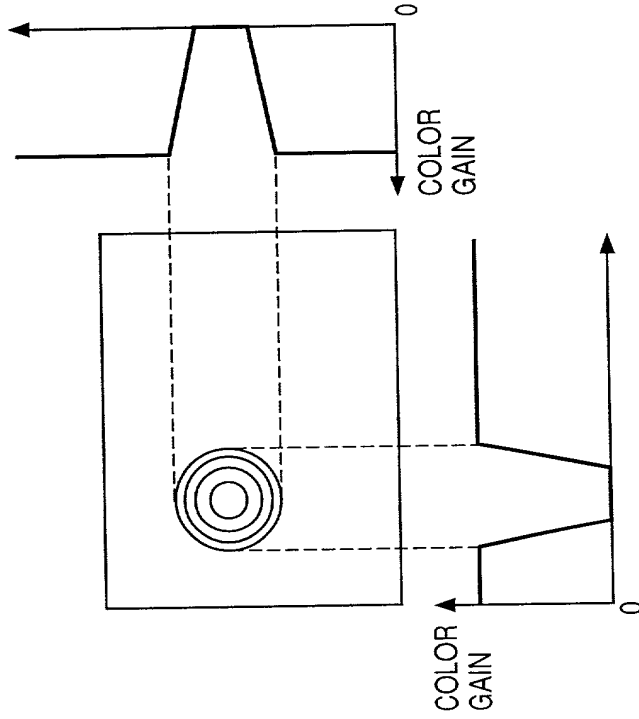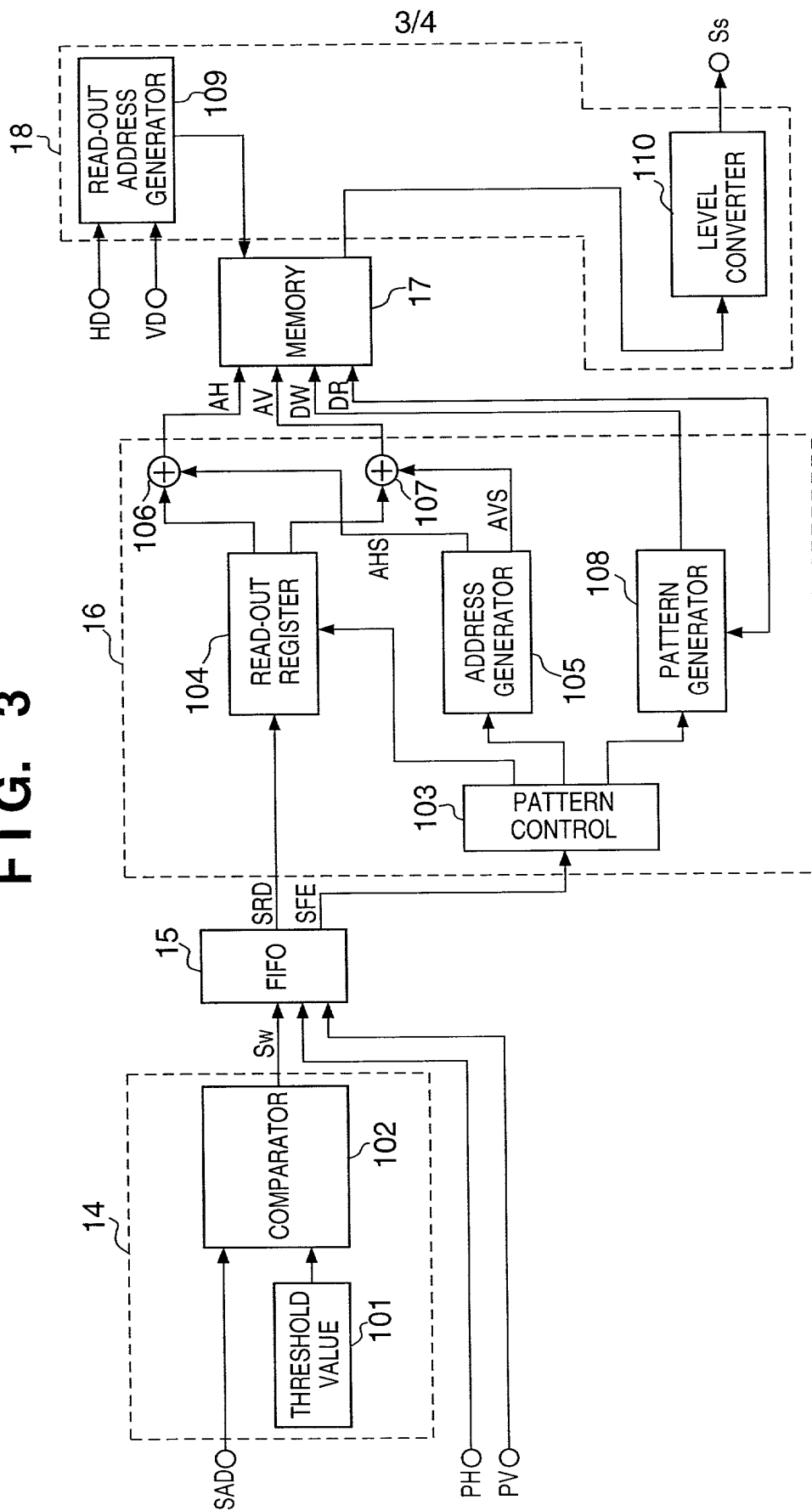
COMBINED DECLARATION AND POWER OF ATTORNEY FOR ORIGINAL , DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

 IMAGE PROCESSING APPARATUS, METHOD AND COMPUTER-READABLE STORAGE MEDIUM

the specification of which

      a. [x] is attached hereto

      b. [   ] was filed on _____ as application Serial No. _____ and
           was amended on _____(if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

      C. [   ] was described and claimed in International Application No._____filed on
      _____and as amended on _____.(if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby specify the following as the correspondence address to which all communications about this application are to be directed:

      SEND CORRESPONDENCE TO: MORGAN & FINNEGAN, L.L.P.
                                  345 Park Avenue
                                  New York, N.Y. 10154

      DIRECT TELEPHONE CALLS TO: MICHAEL M. MURRAY
      (212) 758-4800

      [X] I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or under § 365(b) of any foreign application(s) for patent or inventor's certificate or under § 365(a) of any PCT international application(s) designating at least one country other than the U.S. listed below and also have identified below such foreign application(s) for patent or inventor's certificate or such PCT international application(s) filed by me on the same subject matter having a filing date within twelve (12) months before that of the application on which priority is claimed:

      [X] The attached 35 U.S.C. § 119 claim for priority for the application(s) listed below forms a part of this declaration.

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Country/PCT	Application Number	Date of filing (day,month,yr)	Date of issue (day,month,yr)	Priority Claimed
Japan	11-041860	19, 02, 1999		[x]YES [ ]NO

[   ] I hereby claim the benefit under 35 U.S.C. § 119(e) of any U.S. provisional application(s) listed below.

Provisional Application No.   Date of filing (day, month, yr)

ADDITIONAL STATEMENTS FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART OR PCT INTERNATIONAL APPLICATION(S DESIGNATING THE U.S.)

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) or under § 365(c) of any PCT international application(s) designating the U.S. listed below.

US/PCT Application Serial No.	Filing Date,	Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)

US/PCT Application Serial No.	Filing Date,	Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)

[ ] In this continuation-in-part application, insofar as the subject matter of any of the claims of this application is not disclosed in the above listed prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or Imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys and/or agents with full power of substitution and revocation, to prosecute this application, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith: John A. Diaz (Reg. No. 19,550), John C. Vassil (Reg. No. 19,098), Alfred P. Ewert (Reg. No. 19,887), David H. Pfeffer, P.C. (Reg. No. 19,825), Harry C. Marcus (Reg. No. 22,390), Robert E. Paulson (Reg. No. 21,046), Stephen R. Smith (Reg. No. 22,615), Kurt E. Richter (Reg. No. 24,052), J. Robert Dailey (Reg. No. 27,434), Eugene Moroz (Reg. No. 25,237), John F. Sweeney (Reg. No. 27,471), Arnold I. Rady (Reg. No. 26,601), Christopher A. Hughes (Reg. No. 26,914), William S. Feiler (Reg. No. 26,728), Joseph A. Calvaruso (Reg. No. 28,287), James W. Gould (Reg. No. 28,859), Richard C. Komson (Reg. No. 27,913), Israel Blum (Reg. No. 26,710), Bartholomew Verdirame (Reg. No. 28,483), Maria C. H. Lin (Reg. No. 29,323), Joseph A. DeGirolamo (Reg. No. 28,595), Michael A. Nicodema (Ref. No. 33,199), Michael P. Dougherty (Ref. No. 32,730), Seth J. Altas (Reg. No. 32,454), Andrew M. Riddles (Reg. No. 31,657), Bruce D. DeRenzi (Reg. No. 33,676), Michael M. Murray (Reg. No. 32,537) and Mark J. Abate (Reg. No. 32,527); Alfred L. Haffner, Jr. (Reg. No. 18,919), Harold Haidt (Reg. No. 17,509), John T. Gallagher (Reg. No. 35,516), Steven F. Meyer (Reg. No. 35,613); Kenneth H. Sonnenfeld (Reg No. 33,285), Edward A.

Pennington (Reg. No. 32,588), Michael S. Marcus (Reg. No. 31,727) and John E. Hoel (Reg. No. 26,279) of Morgan & Finnegan, L.L.P., whose address is: 345 Park Avenue, New York, New York 10154.

[ ] I hereby authorize the U.S. attorneys and/or agents named hereinabove to accept and follow instructions from _____ _____ as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and/or agents and me. In the event of a change in the person(s) from whom instructions may be taken I will so notify the U.S. attorneys and /or agents named hereinabove.

Full name of sole or first inventor_____Teruo HIEDA_____

Inventor's signature*_____ _Teruo Hieda_____
                                                    date February 3, 2000

Residence_____2108-1-409, Kitahassakucho, Midori-ku, Yokohama-shi,_____
_____Kanagawa-ken, Japan_____

Citizenship_____JAPAN_____
                              c/o CANON KABUSHIKI KAISHA,
Post Office Address____30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan___

Full name of second joint inventor, if any _____

Inventor's signature*_____
                                                    date

Residence _____
_____

Citizenship_____

Post Office Address_____

[ ] ATTACHED IS ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR SIGNATURE BY THIRD AND SUBSEQUENT INVENTORS FORM.

* Before signing this declaration, each person signing must:

1. Review the declaration and verify the correctness of all information therein; and

2. Review the specification and the claims, including any amendments made to the claims.

After the declaration is signed, the specification and claims are not to be altered.

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To the inventor(s):

The following are cited in or pertinent to the declaration attached to the accompanying application:

Title 37, Code of Federal Regulation, § 1.56

Duty to disclose information material to patentability.

(a)   A patent by its very nature is affect with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1)   prior art cited in search reports of a foreign patent office in a counterpart application, and

(2)   the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

Title 35, U.S. Code § 101

Inventions patentable

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Title 35 U.S. Code § 102

Conditions for patentability; novelty and loss of right to patent

A person shall be entitled to a patent unless –

(a)   the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent,

(b)   the invention was patented or described in a printed publication in this or foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States, or

(c)   he has abandoned the invention, or

(d)   the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate field more than twelve months before the filing of the application in the United States, or

(e)   the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or

(f)   he did not himself invent the subject matter sought to be patented, or

(g)   before the applicant's invention thereof the invention was made in this country by another had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other ...

Title 35, U.S. Code § 103

Conditions for patentability; non-obvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Title 35, U.S. Code § 112 (in part)

Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms also enable any person skilled in the art to which it pertains, or with which it is mostly nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Title 35, U.S. Code § 119

Benefit of earlier filing date in foreign country; right of priority

An application for patent for an invention filed in this country by any person who has, or whose legal representatives or assigns have, previously regularly filed an application for a patent for the same invention in a foreign country which affords similar privileges in the case of applications filed in the United States or to citizens of the United States, shall have the same effect as the same application would have if filed in this country on the date on which the application for patent for the same invention was first filed in such foreign country, if the application in this country is filed within twelve months from the earliest date on which such

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foreign application was filed; but no patent shall be granted on any application for patent for an invention which had been patented or described in a printed publication in any country more than one year before the date of he actual filing of the application in this country, or which had been in public use or on sale in this country more than one year prior to such filing.

<u>Title 35, U.S. Code § 120</u>

Benefit or earlier filing date in the United States

An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States, or as provided by section 363 of this title, which is filed by an inventor or inventors named in the previously filed application shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application.

Please read carefully before signing the Declaration attached to the accompanying Application.

If you have any questions, please contact Morgan & Finnegan, L.L.P.

FORM:COMB-DEC.NY
Rev. 5/21/98

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